

## FAN SHROUD ASSEMBLY

### BACKGROUND OF THE INVENTION

#### Field of the Invention

5        [01]    The present invention relates to a fan shroud assembly.

#### Background of the Related Art

      [02]    In general, an engine room of a vehicle includes an engine which is a vehicle driving device, a cooling device for preventing overheating of the engine, and an air conditioning  
10    device for purifying air of a passenger side inside the vehicle.

      [03]    A cooling method of the engine of the vehicle is divided into an air-cooling type and a water-cooling type. The water-cooling type engine cooling method is to cool the engine using coolant, which flows along the outer surface of the engine.

15        [04]    The water-cooling type engine cooling device includes a radiator attached to the front of the engine of the vehicle for cooling the coolant of the engine, and a fan assembly attached to the radiator for enhancing heat exchanging efficiency.

      [05]    The fan shroud assembly generally includes a fan, a  
20    driving motor for rotating the fan, and a fan shroud for supporting the fan.

      [06]    FIG. 1 is a perspective view of a conventional fan shroud assembly equipped with a fan eccentrically mounted, and FIG. 2 is a sectional view taken along the line of I-I of FIG. 1.

[07] As shown in the drawings, the fan shroud assembly 10 includes: a plenum 11 having a first plenum portion 11a of a larger side and a second plenum portion 11b of a smaller side, the first and second plenum portions 11a and 11b being  
5 eccentrically mounted corresponding to the front of the radiator by a support structure(not shown); a airflow guide portion 15 formed on an air discharge side of the plenum 11, a fan 14, which has a blade 12 and a band 13 for connecting the outer end of the blade 12, a motor mounting 16 located at the center of the  
10 airflow guide portion 15 for mounting of a motor 18; and a stator 17 for connecting the motor mounting 16 and the airflow guide portion 15.

[08] Here, the airflow guide portion 15 is located at a portion where the first plenum portion 11a and the second plenum  
15 portion 11b are located at eccentric positions to each other.

[09] As described above, the fan 14 receiving driving power of the motor 18 is rotated, the air passing the radiator is inhaled and guided by the plenum 11, and then, discharged to an engine side(not shown) through the stator 17 of the airflow guide  
20 portion 15.

[10] However, according to the prior arts, as the fan 14 is not located at the center of the plenum 11 but biased to one side, in a state in which a connection point P1 between the first plenum portion 11a and the airflow guide portion 15 is equal to

the lowermost end of a height BH of the band 13, the first plenum portion 11a is formed straight downwardly, and a height H1 from the bottom B of the plenum 11 to the connection point P1 between the first plenum portion 11a and the airflow guide portion 15 is equal to a height H2 from the bottom B of the plenum 11 to a connection point P1' between the second plenum portion 11b and the airflow guide portion 15.

[11] Because the height H1 from the bottom B of the plenum 11 to the connection point P1 between the first plenum portion 11a and the airflow guide portion 15 is lower than or equal to the height H0 from the bottom B to the lowermost end of the band 13, the air flow area is reduced, and thereby, the prior art has several problems that airflow is reduced and noise is generated.

[12] U. S. Patent No. 5024267 will be described hereinafter with reference to FIG. 3. U. S. Patent No. 5024267 discloses a cooling apparatus which does not have any band.

[13] As shown in the drawing, a cylindrical portion 21 of a shroud 20 of the cooling apparatus, in which a fan is disposed, is biased to one side as shown in FIGS. 1 and 2.

[14] The shroud 20 has a first plenum portion 22 of a larger side and a second plenum portion 23 of a smaller side as the cylindrical portion 21 is biased to one side.

[15] Here, the height H1 from the lowermost end of the cylindrical portion 21 to the first plenum portion 22 is equal to

the height H2 from the lowermost end of the cylindrical portion 21 to the second plenum portion 23.

[16] That is, as in the prior arts of FIGS. 1 and 2, the height H1 from the bottom B of the plenum 11 to the connection point P1 between the first plenum portion 11a and the airflow guide portion 15 is equal to the height H2 from the bottom B to the connection point P1' between the second plenum 11b and the airflow guide portion 15. Furthermore, also the above prior art has the above problems that the airflow is reduced and noise is generated, as the prior art does not have the band 13 shown in FIGS. 1 and 2.

[17] As another example of the prior arts, U. S. Patent No. 6099247 will be described. Referring to FIGS. 4 and 5, a fan shroud for internal combustion engine according to U. S. Patent No. 6099247 includes an intake manifold 31 attached to one side (in a right direction) of an internal combustion engine 30, and an exhaust manifold 32 attached to the other side (in a left direction) of the internal combustion engine 30, which is an exhaust system part.

[18] A cooling device 33 is mounted in front of the internal combustion engine 30.

[19] The cooling device 33 has a cooling fan 34 attached by a fan shaft 35 to internal combustion engine 30; and a radiator 36 is installed, opposite to the cooling fan 34.

[20] Attached to the radiator 36 is a fan shroud 38, equipped with an airflow guide portion 37 which encircles the cooling fan 34 and is formed as a circle.

[21] Here, the cooling fan 34 is located inside the airflow  
5 guide portion 37. To increase cooling air, a clearance C1 between the airflow guide portion 37 and the cooling fan 34, which belongs to a first plenum portion 38a of a larger side of the fan shroud 38, is larger than a clearance C2 between the  
10 airflow guide portion 37 and the cooling fan 34, which belongs to a second plenum portion 38b of a smaller side of the fan shroud 38. However, also, U. S. Patent No. 6099247 still has the above problems that the airflow is reduced and noise is generated.

[22] As the cooling fan 34 is rotatably mounted on the fan shaft 35 rotating by directly receiving driving power of the  
15 internal combustion engine 30, the cooling fan 34 is vibrated together with the driving internal combustion engine 30. Thereby, the air does not flow uniformly but flows irregularly, and so, the cooling efficiency is reduced.

[23] U. S. Patent No. 4213426, which is another example of  
20 the prior arts, will be described hereinafter with reference to FIG. 6.

[24] As shown in the drawing, a shaft 43 rotated by receiving driving power of an engine 42 is attached to a vehicle

frame 40 in front of an end of the engine 42 mounted by the medium of a brocket 41.

[25] A hub 44 is fixed to an end of the shaft 43, a number of blades 45 are disposed on the hub 44, and a fan shroud 46 that  
5 is integral with the outer tips of the blades 45.

[26] The hub 44, the blades 45 and the fan shroud 46 are vibrated together with the driving engine 42 as they are rotated by receiving driving power of the engine 42. To inhale the vibration, an outer shroud assembly 51 connected with a radiator  
10 50 is attached to the outside of the fan shroud 46, the outer shroud assembly 51 is moved flexibly.

[27] However, the fan shroud assembly according to the prior art cannot flow the air in a uniform direction but flows the air in an irregular direction due to the vibration in spite  
15 of the outer shroud assembly 51. Moreover, the fan shroud assembly has a problem in that the air flow is reduced and noise is generated.

#### SUMMARY OF THE INVENTION

20 [28] Accordingly, the present invention has been made in view of the above problems, and it is an object of the present invention is to provide a fan shroud assembly which can change the height of the plenum portion, which is a wider portion, when the fan is located not at the center of the plenum but at the

eccentric position to secure a larger plenum area so as to increase airflow, and improve its performance, i.e., reduction of power consumption and noise.

[29] To achieve the above object, according to the present invention, there is provided a fan shroud assembly includes: a rectangular-shaped plenum having a first plenum portion of a larger side and a second plenum portion of a smaller side, which are mounted eccentrically; a fan shroud formed on an air discharge side of the plenum, the fan shroud having a airflow guide portion, in which a fan having a blade and a band for connecting the outer end of the blade, is mounted; and a motor for driving the fan, wherein a connection point between the first plenum portion and the airflow guide portion is located within a height(BH) of the band, and wherein a height(H1) from the bottom of the plenum to connection point between the first plenum portion and the airflow guide portion is higher than a height(H2) from the bottom of the plenum to connection point between the second plenum portion and the airflow guide portion to satisfy the following Expression:  $H1 > H2$ .

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#### **BRIEF DESCRIPTION OF THE DRAWINGS**

[30] FIG.1 is a perspective view of a conventional fan shroud equipped with a fan mounted eccentrically;

[31] FIG.2 is a sectional view taken along the line of "I-I" of FIG. 1;

[32] FIG.3 is a perspective view of a shroud of a cooling device according to the prior arts;

5 [33] FIG.4 is a plan view of an internal combustion engine according to the prior arts;

[34] FIG. 5 is a rear view of a radiator of FIG. 4;

[35] FIG. 6 is a partially sectional view of another cooling device according to the prior arts;

10 [36] FIG. 7 is a sectional view of a fan shroud assembly according to a first preferred embodiment of the present invention; and

[37] FIG. 8 is a sectional view of a fan shroud assembly according to a second preferred embodiment of the present  
15 invention.

#### **DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT**

[38] Reference will now be made in detail to the preferred embodiments of the present invention, examples of which are  
20 illustrated in the accompanying drawings.

[39] FIG. 7 is a sectional view of a fan shroud assembly according to a first preferred embodiment of the present invention, and FIG. 8 is a sectional view of a fan shroud

assembly according to a second preferred embodiment of the present invention.

[40] As shown in the drawings, the fan shroud assembly according to the present invention includes a fan shroud and a  
5 motor 180.

[41] The fan shroud assembly according to the present invention includes: a rectangular-shaped plenum 110 having a first plenum portion 110a of a larger side and a second plenum portion 110b of a smaller side, the first and second plenum  
10 portions 11a and 11b being mounted eccentrically corresponding to the front of the radiator; the fan shroud formed on an air discharge side of the plenum 110, the fan shroud having a airflow guide portion 150 in which a fan 140 having a blade 120 and a band 130 for connecting the outer end of the blade 120 is  
15 positioned; and the motor 180 for driving the fan 140.

[42] The motor 180 is located at the center of the airflow guide portion 150 and attached to a motor mounting 160, and the motor mounting 160 is connected to the airflow guide portion 150 by the medium of a stator 170.

20 [43] A connection point P2 between the first plenum portion 110a and the airflow guide portion 150 is located within a height BH of the band 130 of the fan 140.

[44] As described above, that the connection point P2 between the first plenum portion 110a and the airflow guide

portion 150 is within the height BH of the band 130 means that the connection point P2 between the first plenum portion 110a and the airflow guide portion 150 is formed upwardly on the basis of the band 130.

5        [45] Therefore, the above structure can improve performance of the fan shroud assembly by increasing the plenum area in comparison of the prior arts.

10        [46] In more detail, as shown in FIGS. 7 and 8, a height H1 from the bottom B of the plenum 110 to connection point P2 and P4 between the first plenum portion 110a and the airflow guide portion 150 is higher than the height H2 from the bottom B of the plenum 110 to connection point P3 and P5 between the second plenum portion 110b and the airflow guide portion 150. So, the above satisfies the following Expression:  $H1 > H2$ .

15        [47] As shown in FIG. 7, a first bending portion 110a' is formed by bending an edge portion of the first plenum portion 110a toward the bottom B of the plenum 110 to a predetermined height h1, and a second bending portion 110b' is formed by bending an edge portion of the second plenum portion 110b to a  
20 height h2 lower than the height h1 of the first bending portion 110a'. So, the above satisfies the following Expression:  $h1 > h2$ .

[48] Meanwhile, as shown in FIG. 8, the first bending portion 110a' is formed by bending the edge portion of the first plenum portion 110a toward the bottom B of the plenum 110 to the

predetermined height  $h_1$ , and the second bending portion 110b' is formed by bending then edge portion of the second plenum portion 110b to the height  $h_2$  equal to the height  $h_1$  of the first bending portion 110a'. So, the above satisfies the following Expression:

5  $h_1 = h_2$ .

[49] That is, as shown in FIG. 8, when the height  $H_1$  from the bottom B of the plenum 110 to the connection point P4 between the first plenum portion 110a and the airflow guide portion 150 is higher than the height  $h_1$  of the first bending portion 110a' ( $H_1 > h_1$ ), the first plenum portion 110a excepting the first bending portion 110a' is downwardly inclined on the basis of the connection point P4.

[50] On the contrary, as shown in FIG. 7, when the height  $H_1$  from the bottom B of the plenum 110 to the connection point P4 between the first plenum portion 110a and the airflow guide portion 150 is equal to the height  $h_1$  of the first bending portion 110a' ( $H_1 = h_1$ ), the first plenum portion 110a excepting the first bending portion 110a' is formed evenly on the basis of the connection point P2.

20 [51] Meanwhile, as shown in FIGS. 7 and 8, the height  $H_2$  from the bottom B of the plenum 110 to the connection point P3 and P5 between the second plenum portion 110b and the airflow guide portion 150 may be formed higher than the height  $h_2$  of the

second bending portion 110b' to satisfy the following Expression:  
 $H2 > h2$ .

[52] As shown in FIG. 7, the height  $H2$  from the bottom B of the plenum 110 to the connection point P3 and P5 between the  
5 second plenum portion 110b and the airflow guide portion 150 may be formed lower than the height  $h1$  of the first bending portion 110a' to satisfy the following Expression:  $H2 < h1$ .

[53] As shown in FIG. 8, the height  $H2$  from the bottom B of the plenum 110 to the connection point P3 and P5 between the  
10 second plenum portion 110b and the airflow guide portion 150 may be formed higher than the height  $h1$  of the first bending portion 110a' to satisfy the following Expression:  $H2 > h1$ .

[54] As shown in FIGS. 7 and 8, the height  $H1$  from the bottom B of the plenum 110 to the connection point P2 and P4  
15 between the first plenum portion 110a and the airflow guide portion 150 may be formed higher than the height  $h2$  of the second bending portion 110b' to satisfy the following Expression:  $H1 > h2$ .

[55] As a result of tests of the fan shroud assembly of the  
20 present invention and the prior arts, which are attached to a heat exchanger, in connection with airflow, power consumption and noise, the fan shroud assembly according to the present invention saved power consumption of about 10% in conditions of the same airflow and noise, compared with the prior arts.

[56] Therefore, a fan shroud assembly of the present invention can change the height of the plenum portion, which is a wider portion, when the fan is located not at the center of the plenum but at the eccentric position to secure a larger plenum  
5 area so as to increase airflow, and improve its performance, i.e., reduction of power consumption and noise.

[57] While the present invention has been described with reference to the particular illustrative embodiments, it is not to be restricted by the embodiments but only by the appended  
10 claims. It is to be appreciated that those skilled in the art can change or modify the embodiments without departing from the scope and spirit of the present invention.